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ABSTRACT

The authors support the use of manual communication with the non-verbal autistic child and suggest that the exercise of manual communication may facilitate the functioning of spoken communication. Research is reviewed in the following areas: the marked peculiarities in the autistic child's perception of and attention to stimuli within or across various sensory modalities, the distinction between mute and echolalic autistic children, the efficacy of simulataneous use of gesture and speech communication, and evidence which suggests an overlap in the neural control for speaking and for certain activities of the upper limbs. An experiment in which 11 autistic children given gestural training showed progress in the frequency and clarity of verbalization is discussed, and a general model for the logical and physiological interconnection of speech and graphic language systems is mentioned. (SBH)

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# The Possible Function of Sign Language in Facilitating Verbal Communication in Severely Dysfunctional Non-verbal Children[1] [2]

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## The Possible Function of Sign Language in Facilitating Verbal Communication in Severely Dysfunctional Non-verbal Children

In comparison to original conceptualizations of autism which stressed affect isolation as a primary symptom (e.g. Bettelheim, 1967), a number of investigators (e.g. Kanner, 1943; Rimland, 1964; Creak, 1964; Lovaas et al., 1966; Ricks and Wing, 1975) have pointed to a deficiency in language and communication skills as perhaps the most salient feature of the autistic syndrome. Rutter (1968), in fact, has suggested that the autistic child's difficulties with interpersonal relationships and intrapersonal functioning are secondary to a basic inability to communicate effectively. De Ajuriaguerra (1966) has also discussed how a failure to acquire language might result in a host of severe, yet secondary, emotional problems for children with a variety of speech and language disorders. Among others, Wing (1966) has noted that linguistic ability is a reliable prognostic indicator for the autistic child. Liben's (1975) summary of research with the deaf population, too,suggests that language is a crucial variable influencing nearly all aspects of the child's social, intellectual and emotional development.

In our own research with severely dysfunctional, non-verbal children, we have adopted a working treatment philosophy based upon the concerns of those authors' mentioned above - that an effective means of communication is a necessary ingredient for normal development, and that communication training procedures may be employed to facilitate therapeutic progress in a number of areas.

Relying a good deal upon the pioneering work of Lovaas et al. (1966) and Creedon (1973), and through a simultaneous communication approach (where speech and sign language are used together), we are employing operant conditioning procedures in the teaching of gestural communication skills to severely dysfunctional,non-verbal children. While the therapist uses both speech and sign in all of his messages to the children, and while the child is of course reinforced for any appropriate verbal responses he may offer, primary emphasis remains upon the gestural system and the child's acquisition of a functional repertoire in sign language.

Our work within this area to date (Konstantareas et al., 1974, 1975), along with the reports of other researcher-therapists (Creedon, 1973; Miller & Miller, 1973; Webster et al., 1973) in the field, has brought us to the conclusion that simultaneous communication procedures (with an emphasis upon the gestural component) may represent a relatively effective treatment for severely dysfunctional (i.e. "autistic" and "autistic-like") non-verbal children. A host of experimental evidence has recently accumulated which suggests that the perceptual and information processing abilities of this population of children may be better suited for a visual-motor (sign language) as compared to a vocal-auditory (speech) system of communication. We have noted too, however, along with other researchers (Creedon, 1973; Miller & Miller, 1973), that the spoken and manual components of this approach are integrally related, and that in fact some children receiving this type of training seem to progress not only in the acquisition of gestural skills but also demonstrate improvement in their ability to vocalize and/or verbalize. As a tentative explanatory hypothesis for the observed efficacy of simultaneous

communication procedures, and for preliminary reports of increased verbalization or vocalization as an "indirect" result of such procedures, we suggest that: (1) the perceptual and information processing abilities of this population of non-verbal children are more suitable to a manual than a spoken communication system; and (2) those neuronal networks which may be involved in these two systems are, to some extent, "overlapping" such that the two are potentially integrative or such that the exercise of one system may facilitate the functioning of the other.

Perceptual Abilities and Abnormal Response Patterns

Within the past decade, there has begun to accumulate a body of literature which strongly suggests that autistic and autistic-like children have marked peculiarities in their attention to, and perception of, stimuli within or across various sensory modalities. Lovaas et al. (1971a, 1971b), Schreibman and Lovaas (1973), and Reynolds et al. (1974) have reported rather extensively upon the phenomenon of "overselectivity" in autistic children. That is, when presented with a multi-modal stimulus complex (e.g., involving visual, auditory and tactile components), autistic children, unlike normals, tend to selectively respond to only one aspect of the complex (e.g. the tactile) to the exclusion of the others (e.g. visual and auditory). This same phenomenon has also been found when multiple cues within a single stimulus modality have been presented (Koegel & Wilhelm, 1973; Reynolds et al. 1974; Schreibman & Lovaas, 1973). Even within a therapeutic setting, Lovaas et al. (1971b) have reported what appears to be a further instance of overselectivity. After a great many trials, for example, a child had learned to imitate the therapist's vocalization "ah". When the therapist covered his mouth while presenting the

discriminate stimulus on subsequent trials, however, the discrimination was totally lost. Apparently, the child had been attending to the visual components of the therapist's models during training trials, to the exclusion of the auditory input. It was through similar observation that Webster et al.( 1973) began to stress the gestural rather than verbal component of communication in their work with an autistic boy. These findings have obvious implications for our work with these children. We must be assured that we are presenting them, through our training procedures, with cues and information to which they can attend and which they are able to process adequately.

A series of studies by Hermelin and O'Connor (1964, 1965, 1970) has also offered much in the way of delineating the autistic child's selective and restricted attentional and information-processing abilities. From their work, it seems that autistic children do not attend and take advantage of all available sensory input as normal children do, but tend to prefer either auditory or visual information, most likely the visual. The same finding was reported by Tubbs (1966) in her use of the Illinois Test of Psycholinguistic Abilities (I.T.P.A.) with psychotic children. She found them to be particularly impaired in auditory information processing. Condon's (1975) consideration of interactional synchrony in normal and autistic children, too, showed the autistic child to respond in a distorted fashion to auditory input although he was unable to obtain comparable deficits with the visual modality. That the autistic child also appears to be comparatively attentive to, and able to use tactile and kinesthetic information in problem-solving tasks (Hermelin & O'Connor, 1970), also offers support for pursuing a manual means of communication with this population.

Generally, then, the empirical evidence available appears to support, for at least some children, training procedures which emphasize visual as opposed to auditory information, and those where tactile and kinesthetic information can be of use. In the present context of communication training, a gestural as opposed to a speech system would seem to be indicated.

Information Processing: Imagery and Mental Representation

Premack (1972) has argued that there is a tendency in the young child to represent experience "iconically" (i.e. through visual imagery), and that, as the child begins to acquire language, he must make the switch to phonetic representation. Premack has also shown that echolalic as compared to mute autistic children perform better on modelled verbal tasks (1972); the mute children in his study, however, did better than the echolalics in imitating motoric sequences. This may in retrospect appear to be an obvious finding, but it was one of the first attempts to draw a distinction between mute and echolalic autistic children and it suggests that the mute autistic child is not adept at representing or storing auditory, verbal information. From the studies reviewed previously, in fact, it would appear that such children are a good deal more reliant upon visual (and possibly motoric) representation.

A review by Blanc (1974) pointed to the same conclusion for the younger, normal child, where in fact there is a preference for gestural as opposed to verbal responding to adult's questions, when such responding is sufficient to communicate the desired message. A number of studies exploring the effect of visual and propositional representation on learning performance (e.g. Bower, 1972; Paivio, 1966, 1969; Paivio, Yuille & Madigan, 1968; Begg & Paivio, 1969) has indicated

too, that visual imagery is closer to direct perceptual events than propositional representation, and that the visual representation of task items can substantially facilitate paired-associate learning.

Generally, it would appear that the representational requirements of a gestural as opposed to a spoken system of communication are more in line with the non-verbal autistic child's preferred modes of attention and mental processing. The more primitive level of visual representation would, furthermore, appear consonant with the generally lower levels of intellectual functioning in this population (Wing, 1966), and the mute child's preferred mode of information-gathering through visual as compared to auditory channels.

Gesture Only vs. Simultaneous Communication

Having enumerated a number of reasons as to why a gestural as opposed to a vocal system of communication seems to be recommended for this population of non-verbal children, then, an obvious question may be, why do we continue to use verbalization in our training procedures? There are several lines of reasoning which support the use of gestures and speech together with these children.

As we began our work with five dysfunctional children two years ago, it became apparent that, although none of the children had any functional speech, some of them did have a degree of receptive speech ability, an outcome perhaps of the emphasis their parents and teachers placed on this modality. In introducing a gestural system to them, we found that their understanding of speech often appeared to facilitate the acquisition of meaning through gesture. Word-sign associations seemed to be possible in some cases, facilitating, perhaps, their understanding of this new "language game" - that what you do with your

hands mean something to others. Furthermore, we felt that any incidental gains made in regard to speech could only be of benefit to the child.

More recently, we have noted through some pilot research, that the elimination of the vocal component of this simultaneous communication approach seems to affect the children's attention to the person attempting to communicate with them. When signs were used to the exclusion of speech, it became more difficult to maintain contact with the children: eye-to-eye contact seemed toddecrease, and it appeared that the children were generally disturbed at the anticipated but now absent speech component.

But perhaps the strongest support for continuing to employ gesture and speech together has come from our observations, and those of others (Creedon, 1973; Miller & Miller, 1973), that as some of the children proceeded through this training they appeared to become more proficient in the understanding of speech, and they seemed to begin to verbalize and/or vocalize more frequently and more clearly.

Neuropsychological Evidence

In our search for understanding why this seems to be the case, we came upon the work of Kimura (1973a, 1973b, in press; Kimura & Archibald, 1974) who has reported evidence suggesting an overlap in the neural control for speaking and for certain activities of the upper limbs. That aphasic patients (with left hemispheric lesions) lose their ability to perform novel motor sequences with the hands (Kimura & Archibald, 1974), and that disorders of manual communication in the deaf occur from left hemispheric lesions, as do disorders of vocal

communication (Kimura, in press), lend support to this hypothesis. Kimura (in press) also cites the association between hand preference and speech lateralization in the brain, and the frequent association of hand movements with speaking in normals and of vocal utterances with hand signing in the deaf as offering further support to her notion of a neural overlap.

If this is indeed the case, and if we consider the well-documented plasticity of the brain for carrying out language-related functions during the child's first 12 or so years (Lenneberg, 1966), we may speculate that gestural training for the non-verbal child may possibly result in a transference effect to the speech mechanisms and pathways. We find, for the population of concern, that both receptive and productive speech are at a very low level, if evidenced at all. It would therefore seem safe to assume that whatever central or peripheral mechanisms are responsible for speech and language in the normal child are for some reason non-operational in the severely dysfunctional, non-verbal child. If there does exist a neural overlap in the control of speech and of motor functioning of the upper limbs, it may not be unreasonable to propose that the exercise of the latter system could lead to the stimulation of the former.

Eccles' (1961) tenet that use strengthens neural transmission would suggest, in fact, that even such indirect stimulation of neural centres controlling speech may result in the increased use and functioning of the speech mechanism, from neural centres to the speech musculature. This does, of course, represent a good deal of speculation at the present time, though hopefully heuristic speculation.

Some Anecdotal Evidence and Preliminary Experimental Results

We have noted, in several of the eleven children we have treated thus far (training not extending beyond 20 months), some progress in the frequency and clarity of verbalization. For three of these four children, none of whom had any functional speech at their inception into the programme, words began to appear simultaneously with their signed counterparts. In some cases, the children elected to drop the manual component and employ only the spoken. The fourth child, originally one of the poorest of our present sample in terms of vocal performance, has recently begun using some words (at times in sequence) as she signs, and at times also will speak without signing. In some of the other children with whom we have been involved, there has been an apparent increase in the quantity of vocalizations produced.

As a first step in trying to systematically substantiate these observations, we have employed a pre - post design in assessing the articulation abilities of five children participating in the programme over the past year. The Fisher-Logemann Test of Articulation Competence was administered twice to these children, with a 7-month lag between testings. Table 1 lists the chronological and developmental age scores, and diagnosis for each child in the sample.

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Insert Table 1 about here

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A control group of seven children not receiving gestural training, but matched on the basis of chronological and developmental age, diagnosis, and receptive and productive speech abilities, was also employed. Subjects were required to offer imitative responses to the test items, with the examiner presenting the appropriate verbal cues.

We are able, at this point, to offer results of a preliminary analysis of this data (though without the control group comparison, as a two-month delay in their post-testing has been necessary). Table 2 presents the five children's performance on the Articulation test, according to correct and approximate responses to test items and by pre- and post- conditions.

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Insert Table 2 about here

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While all children appeared to display at least some slight progress from pre- to post-testing, statistical tests showed only a trend for improvement (overall responding: $t = 1.510$, $df = 4$, $p < .15$; approximate responding: $t = 1.675$, $df = 4$, $p < .10$; correct responding: $t = 0.497$, $df = 4$, $p > .30$). That these apparent gains took place over a relatively brief interval of 7 months, however, is encouraging in light of the fact that up until their involvement in a gestural programme all of the children had received some degree of speech training with negligible results. We notice, too, a good deal of variability in performance between children. Maureen and Larry, whose gains were the largest, were in fact somewhat echolalic at the beginning of the programme, while the other three children displayed no or extremely poor ability at imitative speech.

These results, while not conclusive (especially without full data from the control group), perhaps do offer some confirmation of our observations of increased verbalization and vocalization of the children in our simultaneous communication programme. The measure employed here may not be fully adequate in giving us a complete picture of the children's vocal abilities. Within the confines of a controlled assessment situation, though, it has offered indications supporting

what we have noted of the children's increasing vocal performance as they progress through a primarily gesturally-oriented programme.

A General Model

Whitaker (1971) proposed a general model for the logical and physiological interconnection of two main language systems (speech and graphics) (See Figure 1.).

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Insert Figure 1 about here

A similar model may be useful in aiding our conceptualization of a possible reciprocal facilitation between the speech and gestural systems. This extension of Whitaker's model is presented in Figure 2.

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Insert Figure 2 about here

As reviewed above, it can be seen that the gestural system allows for the dysfunctional child to receive linguistic information through his strongest perceptual and information processing channels - the visual, tactile, and kinesthetic. The two systems, it is suggested, can become integrated into one if sufficiently exercised. Stimulation of one system would seem to initiate the rudimentary functioning of the other.

:glm
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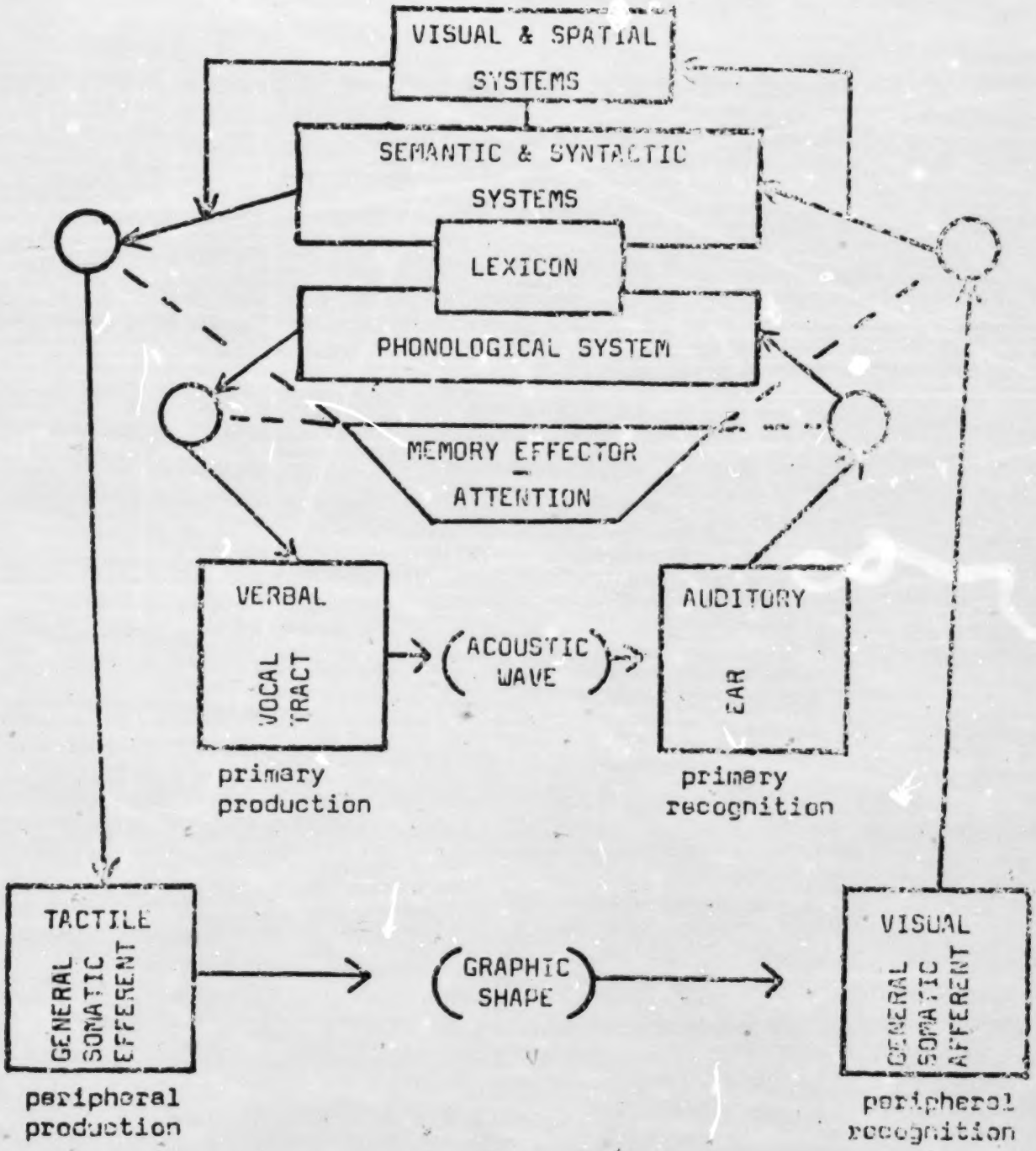


Figure 1. Whitaker's (1971) representation of the major components of the language mechanism, and some systems closely related to it.

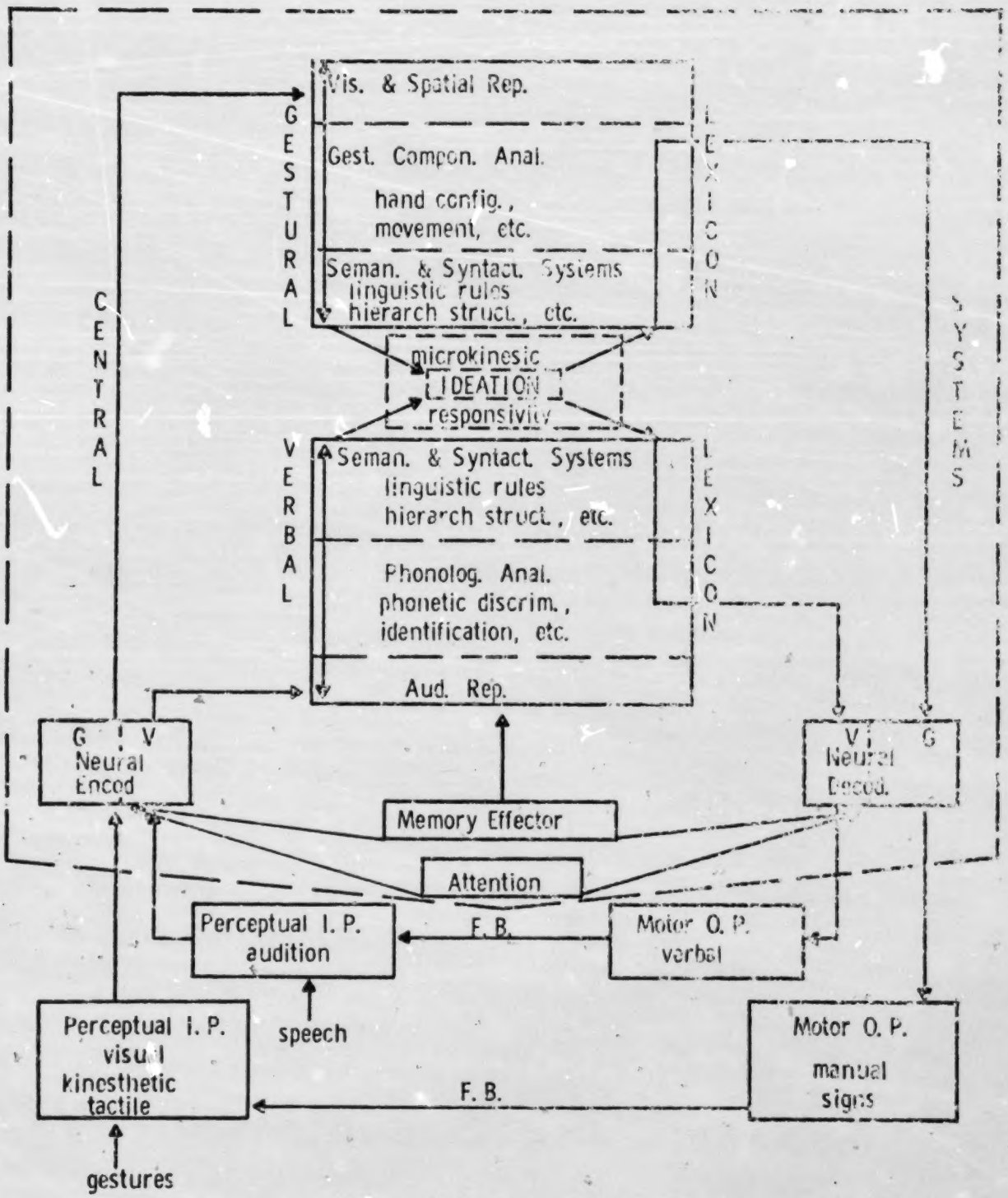


Figure 2. Schematic representation of the processing of verbal, gestural, and simultaneous communication signals (adapted from Whitaker, 1971).

Table 1

Chronological and Developmental Ages* and Diagnoses for the Sample, at Pre-testing

| Subject | C.A. | Alpern & Boll Developmental Age Scores | | | | | Diagnosis |
|---|---|---|---|---|---|---|---|
| | | Physical | Self-help | Social | Academic | Communication | |
| Mary | 9 - 6 | 3 - 2 | 3 - 6 | 3 - 2 | 2 - 6 | 2 - 2 | severe mental retardation with autistic features. |
| Larry | 9 - 3 | 4 - 6 | 3 - 6 | 2 - 2 | 1 -10 | 1 -10 | autism with severe mental retardation |
| Lee | 7 - 7 | 7 - 6 | 5 - 8 | 1 -10 | 3 - 4 | 1 - 0 | neurosensory deafness, bilateral; behaviour disorder with autistic features |
| Brian | 11 - 5 | 2 -10 | 4 - 2 | 2 - 6 | 2 - 8 | 2 - 0 | mental retardation with autistic features |
| Maureen | 7 -10 | 5 - 6 | 3 - 6 | 2 - 4 | 3 - 2 | 1 - 8 | autism with mental retardation |

* Developmental Ages determined from the Alpern and Boll Developmental Profile (1972) at time of pre-testing.

Table 2

Responses of the Experimental Group to Test Items on the Fisher-Logemann Test of Articulation Competence at Pre- and Post-Testing

| Subject | Pre | | | Post | | |
|---|---|---|---|---|---|---|
| | Correct Resp.[1] | Approx. Resp.[2] | Total | Correct Resp. | Approx. Resp. | Total |
| Mary | 1 | 3 | 4 | 2 | 5 | 7 |
| Larry | 38 | 25 | 63 | 43 | 52 | 95 |
| Lee | 0 | 0 | 0 | 0 | 1 | 1 |
| Brian | 3 | 0 | 3 | 2 | 1 | 3 |
| Maureen | 39 | 31 | 70 | 37 | 42 | 79 |
| TOTAL: | 81 | 59 | 140 | 84 | 101 | 185 |
| MEAN: | 16.2 | 11.8 | 28 | 16.8 | 20.2 | 37 |

(1) Correct response: Subject's production of the target phoneme was correctly articulated relative to the examiner's model.

(2) Approximate response: Subject offered a definite and clearly distinguishable attempt at producing the target phoneme, though the vocalization was of a distorted nature.